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# Report on the individual review of the annual submission of Sweden submitted in 2014*

* In the symbol for this document, 2014 refers to the year in which the inventory was submitted, and not to the year of publication.

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# I. Introduction and summary

1. This report covers the review of the 2014 annual submission of Sweden, coordinated by the UNFCCC secretariat, in accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1) (hereinafter referred to as the Article 8 review guidelines). The review took place from 15 to 20 September 2014 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Justin Goodwin (United Kingdom of Great Britain and Northern Ireland), Mr. Michael Gytarsky (Russian Federation) and Ms. Jolanta Merkeliene (Lithuania); energy – Mr. Ralph Harthan (Germany), Ms. Tahira Munir (Pakistan) and Mr. Jongikhaya Witi (South Africa); industrial processes and solvent and other product use – Ms. Nouf Aburas (Saudi Arabia) and Mr. Ole Kenneth Nielsen (Denmark); agriculture – Ms. Hongmin Dong (China) and Mr. Kazumasa Kawashima (Japan); land use, land-use change and forestry (LULUCF) – Mr. Kevin Black (Ireland), Mr. Raehyun Kim (Republic of Korea) and Mr. Vladimir Korotkov (Russian Federation); and waste – Mr. Seungdo Kim (Republic of Korea) and Mr. Gabor Kis-Kovacs (Hungary). Mr. Goodwin and Mr. Witi were the lead reviewers. The review was coordinated by Mr. Matthew Dudley (UNFCCC secretariat).

2. In accordance with the Article 8 review guidelines, a draft version of this report was sent to the Government of Sweden, which provided comments that were considered and incorporated, as appropriate, into this final version of the report. All encouragements and recommendations in this report are for the next annual submission, unless otherwise specified.

3. All recommendations and encouragements included in this report are based on the expert review team's (ERT's) assessment of the 2014 annual submission against the Article 8 review guidelines. The ERT has not taken into account the fact that Parties will prepare the submissions due by 15 April 2015 using the revised "Guidelines for the preparation of national communications by Parties include in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories" (hereinafter referred to as the UNFCCC Annex I inventory reporting guidelines) adopted through decision 24/CP.19. Therefore, when preparing the 2015 annual submissions, Parties should evaluate the implementation of the recommendations and encouragements in this report, in the context of those guidelines.

4. In 2012, the main greenhouse gas (GHG) emitted by Sweden was carbon dioxide ($CO_2$), accounting for 79.3 per cent of total GHG emissions[1] expressed in $CO_2$ equivalent ($CO_2$ eq), followed by nitrous oxide ($N_2O$) (10.7 per cent) and methane ($CH_4$) (8.3 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride ($SF_6$) collectively accounted for 1.6 per cent of the overall GHG emissions in the country. The energy sector accounted for 73.2 per cent of total GHG emissions, followed by the agriculture sector (13.3 per cent), the industrial processes sector (10.2 per cent), the waste sector (2.8 per cent) and the solvent and other product use sector (0.5 per cent). Total GHG emissions amounted to 57,610.45 Gg $CO_2$ eq and decreased by 20.9 per cent between the

[1] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of $CO_2$ equivalent excluding LULUCF, unless otherwise specified.

base year[2] and 2012. The ERT concluded that the description in the national inventory report (NIR) of the trends for the different gases and sectors is reasonable.

5. Tables 1 and 2 show GHG emissions from sources included in Annex A to the Kyoto Protocol (hereinafter referred to as Annex A sources), emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, elected activities under Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively.

6. Information to be included in the compilation and accounting database can be found in annex I to this report.

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for $CO_2$, $CH_4$ and $N_2O$, and 1995 for HFCs, PFCs and $SF_6$. The base year emissions include emissions from sources included in Annex A to the Kyoto Protocol only.

Table 1

**Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol by gas, base year[a] to 2012**

| | | | *Gg $CO_2$ eq* | | | | | | | *Change (%)* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *Greenhouse gas* | *Base year* | *1990* | *1995* | *2008* | *2009* | *2010* | *2011* | *2012* | *Base year–2012* |
| Annex A sources | | $CO_2$ | 57 142.52 | 57 142.52 | 58 969.59 | 49 980.29 | 46 519.84 | 52 283.36 | 48 482.52 | 45 713.25 | –20.0 |
| | | $CH_4$ | 6 985.44 | 6 985.44 | 6 885.04 | 5 249.78 | 5 146.52 | 5 047.13 | 4 944.19 | 4 807.24 | –31.2 |
| | | $N_2O$ | 8 114.07 | 8 114.07 | 7 717.72 | 6 611.95 | 6 450.96 | 6 669.82 | 6 270.55 | 6 191.41 | –23.7 |
| | | HFCs | 132.10 | 4.18 | 132.10 | 868.36 | 869.91 | 848.44 | 820.10 | 774.54 | 486.3 |
| | | PFCs | 343.43 | 376.82 | 343.43 | 225.05 | 35.33 | 158.34 | 183.43 | 68.92 | –79.9 |
| | | $SF_6$ | 126.68 | 107.49 | 126.68 | 83.87 | 80.91 | 72.40 | 60.25 | 55.09 | –56.5 |
| KP-LULUCF | Article 3.3[b] | $CO_2$ | | | | 1 756.49 | 1 799.58 | 1 440.27 | 2 432.71 | 2 523.52 | |
| | | $CH_4$ | | | | NO | NO | NO | NO | NO | |
| | | $N_2O$ | | | | 5.93 | 5.89 | 5.92 | 6.29 | 5.99 | |
| | Article 3.4[c] | $CO_2$ | NA | | | –40 039.85 | –39 437.60 | –39 159.87 | –40 149.43 | –39 596.87 | NA |
| | | $CH_4$ | NA | | | 13.16 | 1.83 | 0.65 | 2.06 | 0.88 | NA |
| | | $N_2O$ | NA | | | 50.34 | 45.81 | 65.83 | 43.67 | 37.55 | NA |

*Abbreviations*: Annex A sources = source categories included in Annex A to the Kyoto Protocol, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] The base year for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for $CO_2$, $CH_4$ and $N_2O$, and 1995 for HFCs, PFCs and $SF_6$. The base year for cropland management, grazing land management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol is 1990. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

Table 2

**Greenhouse gas emissions by sector and activity, base year[a] to 2012**

| | | | Gg $CO_2$ eq | | | | | | | Change (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Sector | Base year | 1990 | 1995 | 2008 | 2009 | 2010 | 2011 | 2012 | Base year - 2012 |
| Annex A sources | | Energy | 53 456.04 | 53 456.04 | 55 164.43 | 46 017.32 | 44 231.64 | 48 384.46 | 44 607.56 | 42 147.59 | –21.2 |
| | | Industrial processes | 6 588.21 | 6 474.50 | 6 744.86 | 6 777.88 | 4 970.58 | 6 784.81 | 6 348.59 | 5 898.77 | –10.5 |
| | | Solvent and other product use | 332.49 | 332.49 | 308.55 | 287.76 | 284.27 | 309.28 | 302.66 | 302.66 | –9.0 |
| | | Agriculture | 9 046.22 | 9 046.22 | 8 723.24 | 7 936.76 | 7 725.40 | 7 802.77 | 7 786.51 | 7 641.43 | –15.5 |
| | | Waste | 3 421.27 | 3 421.27 | 3 233.47 | 1 999.58 | 1 891.59 | 1 798.17 | 1 715.71 | 1 620.00 | –52.6 |
| | | LULUCF | NA | –38 703.18 | –37 901.93 | –35 891.89 | –35 279.32 | –35 137.74 | –35 587.30 | –35 418.25 | NA |
| | | **Total (with LULUCF)** | **NA** | **34 027.34** | **36 272.63** | **27 127.42** | **23 824.16** | **29 941.75** | **25 173.73** | **22 192.20** | **NA** |
| | | **Total (without LULUCF)** | **72 844.24** | **72 730.52** | **74 174.55** | **63 019.30** | **59 103.48** | **65 079.49** | **60 761.03** | **57 610.45** | **–20.9** |
| | | Other[b] | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| KP-LULUCF | Article 3.3[c] | Afforestation and reforestation | | | | –1 374.76 | –1 397.18 | –1 219.87 | –1 338.09 | –1 370.13 | |
| | | Deforestation | | | | 3 137.17 | 3 202.65 | 2 666.06 | 3 777.09 | 3 899.65 | |
| | | **Total (3.3)** | | | | **1 762.41** | **1 805.47** | **1 446.19** | **2 439.00** | **2 529.51** | |
| | Article 3.4[d] | Forest management | | | | –39 976.35 | –39 389.95 | –39 093.39 | –40 103.70 | –39 558.43 | |
| | | Cropland management | NA | | | NA | NA | NA | NA | NA | NA |
| | | Grazing land management | NA | | | NA | NA | NA | NA | NA | NA |
| | | Revegetation | NA | | | NA | NA | NA | NA | NA | NA |
| | | **Total (3.4)** | **NA** | | | **–39 976.35** | **–39 389.95** | **–39 093.39** | **–40 103.70** | **–39 558.43** | **NA** |

*Abbreviations:* Annex A sources = source categories included in Annex A to the Kyoto Protocol, KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NA = not applicable.

[a] The base year for Annex A sources is the base year under the Kyoto Protocol, which is 1990 for $CO_2$, $CH_4$ and $N_2O$, and 1995 for HFCs, PFCs and $SF_6$. The base year for cropland management, grazing land management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol is 1990. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[b] Emissions/removals reported in the sector other (sector 7) are not included in Annex A to the Kyoto Protocol and are therefore not included in national totals.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

# II. Technical assessment of the annual submission

## A. Overview

### 1. Annual submission and other sources of information

7. The 2014 annual submission was submitted on 11 April 2014; it contains a complete set of common reporting format (CRF) tables for the period 1990–2012 and an NIR. Sweden further submitted a revised NIR on 23 May 2014 and on 3 July 2014. Sweden also submitted the information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 11 April 2014. The annual submission was submitted in accordance with decision 15/CMP.1.

8. Sweden submitted revised emission estimates on 16 October 2014 in response to the list of potential problems and further questions raised by the ERT (see paras. 30, 34 and 36 below). The values used in this report are those submitted by Sweden on 16 October 2014.

9. The list of other materials used during the review is provided in annex II to this report.

### 2. Question(s) of implementation raised in the 2013 annual review report

10. The ERT noted that no questions of implementation were raised in the 2013 annual review report.

### 3. Overall assessment of the inventory

11. Table 3 contains the ERT's overall assessment of the annual submission of Sweden. For recommendations for improvements for specific categories, please see the paragraphs cross-referenced in the table.

Table 3
**The expert review team's overall assessment of the annual submission**

| *Issue* | *Expert review team assessment* | *General findings and recommendations* |
|---|---|---|
| The ERT's findings on completeness | | |
| Annex A sources[a] | Complete | Mandatory: none<br>Non-mandatory: Sweden has reported the following categories as "NE": $CH_4$ and $N_2O$ emissions from biomass use in military use (other – mobile); $CO_2$ emissions from transport (oil); $CO_2$ and $CH_4$ emissions from distribution of oil products; $CH_4$ emissions from sinter, coke, aluminium and non-ferrous metal production (metal production – other); $CO_2$ emissions from non-iron ore mining and dressing and from batteries manufacturing (mineral products – other); $CO_2$ and $CH_4$ emissions from base |

| *Issue* | *Expert review team assessment* | *General findings and recommendations* |
|---|---|---|
| | | chemicals for plastic industry and from pharmaceutical industry, $CH_4$ and $N_2O$ emissions from other non-specified (chemical industry – other); $CO_2$ emissions from road paving with asphalt and $CO_2$ emissions from food and drink production |
| | | The ERT encourages the Party to estimate and report emissions from all non-mandatory categories |
| Land use, land-use change and forestry[a] | Complete | Mandatory: none |
| | | Non-mandatory: Sweden has reported the following categories as "NE": the carbon stock changes in dead organic matter and in soils from settlements remaining settlements; $CH_4$ and $N_2O$ emissions from drainage of soils and wetlands in forest land; $CO_2$, $CH_4$ and $N_2O$ from harvest wood products |
| | | The ERT encourages the Party to estimate and report emissions from all non-mandatory categories |
| KP-LULUCF | Complete | |
| The ERT's findings on recalculations and time-series consistency | | |
| Transparency of recalculations | Sufficiently transparent | |
| Time-series consistency | Sufficiently consistent | |
| The ERT's findings on QA/QC procedures | Sufficient | Sweden has elaborated a QA/QC plan and has implemented tier 1 QA/QC procedures in accordance with that plan (see paras. 12, 13 and 56 below) |
| The ERT's findings on transparency | Sufficiently transparent | Please see paragraphs 12, 13, 43–45, 48, 53, 57, 59, 63 and 71 below for category-specific recommendations |

*Abbreviations:* Annex A sources = source categories included in Annex A to the Kyoto Protocol, ERT = expert review team, IPCC = Intergovernmental Panel on Climate Change, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NE = not estimated, QA/QC = quality assurance/quality control.

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the IPCC *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

12. The NIR (section 1.3.5.2) describes the Swedish quality assurance/quality control (QA/QC) system, which includes peer reviews by national sectoral authorities prior to inventory submission. The review is performed by different agencies (e.g. the Swedish Energy Agency, the Swedish Chemicals Agency, the Swedish Board of Agriculture and the Swedish Forest Agency) under the coordination of the Swedish Environmental Protection

Agency. The ERT notes that the results of the internal review of the 2014 annual submission were not presented in the NIR. In response to a question raised by the ERT during the review, Sweden provided information confirming that no errors were discovered during the national peer review of the 2014 annual submission; however, several improvements related to the transparency of the NIR and suggestions for future improvements will be implemented in the 2015 annual submission (e.g. the inclusion of the results of the leisure boat survey performed in 2010 by the Swedish Transport Agency). The ERT encourages Sweden to include the key findings of its internal review and the resulting improvements in the NIR, in order to enhance the transparency of the NIR.

13. The ERT also notes that the tier 2 category-specific QC procedures for the key categories in the agriculture, LULUCF and waste sectors are not described in the NIR. In response to a question raised by the ERT during the review, Sweden provided relevant information on the tier 2 procedures implemented in the 2014 annual submission for the agriculture and LULUCF sectors, and also informed the ERT about planned improvements related to the tier 2 procedures in the waste sector. The ERT welcomed this information and encourages Sweden to include this information in the NIR to enhance transparency.

14. The ERT notes that planned improvements under the category-specific sections of the NIR are not reported (except for the LULUCF sector and the category wastewater handling in the waste sector). In response to a question raised by the ERT during the review, Sweden provided a list of planned improvements for the 2015 annual submission, which includes: implementation of the Intergovernmental Panel on Climate Change (IPCC) *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) and the new UNFCCC Annex I inventory reporting guidelines; improvements related to increasing the transparency of the NIR; development projects related to improving the energy statistics; improved accuracy of information on the disposal of fluorinated gases (F-gases); updated activity data (AD) for the off-road mobile machinery emission model; inclusion of the results of the latest leisure boat survey; and improvements related to the emission factors (EFs) for waste incineration. The ERT welcomes these planned improvements and encourages Sweden to report on planned improvements in its next annual submission.

## 4. Description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Inventory planning

15. The NIR described the national system for the preparation of the inventory. As indicated by Sweden in its NIR, there were no changes to the inventory planning process. The description of the inventory planning process, as contained in the report of the individual review of the annual submission of Sweden submitted in 2013,[3] remains relevant.

16. The ERT noted the recommendation made by the previous ERT, that Sweden improve the national system in a way that would enable it to implement the recommendations provided in the annual review reports in time for its next annual submission, has not been fully implemented as several recommendations from previous annual review reports have not yet been implemented. In response to a question raised by the ERT during the review, Sweden informed the ERT that a number of recommendations could not be implemented due to time constraints relating to the time between the publication of the previous annual review report and the national inventory cycle and due date for reporting under the European Union (EU). However, Sweden informed the ERT

[3] FCCC/ARR/2013/SWE, paragraphs 10 and 11.

that the strong and other important recommendations made in the preliminary findings of the 2013 review were given priority and in most cases were resolved in the 2014 annual submission. Although no changes were made in the national system, additional resources were deployed by Sweden to address the recommendations from the previous review report. Furthermore, Sweden is currently revising the national legislation to adapt it to new EU legislation (the Monitoring Mechanism Regulation). During this revision, there may be changes that increase the possibility to implement more recommendations in time for the next annual submission. The ERT welcomes these possible improvements.

Inventory preparation

17. Table 4 contains the ERT's assessment of Sweden's inventory preparation process. For improvements related to specific categories, please see the paragraphs cross-referenced in the table.

Table 4

**Assessment of inventory preparation by Sweden**

| *Issue* | *Expert review team assessment* | *ERT findings and recommendations* |
|---|---|---|
| *Key category analysis* | | |
| Was the key category analysis performed in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF? | Yes | Level and trend analysis performed, including and excluding LULUCF<br><br>The ERT notes improvement in the latest key category analysis concerning the disaggregation of categories in the LULUCF sector. However, the analysis for the energy sector is still at a high aggregation, which does not allow for understanding of the particular importance of emissions for some categories of this sector. The ERT encourages Sweden to explore performing key category analysis in the energy sector at a greater level of disaggregation (i.e. disaggregating categories by main fuel types) |
| Approach followed? | Both tier 1 and tier 2 | |
| Were additional key categories identified using a qualitative approach? | No | |
| Has the Party identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key | Yes | |

| *Issue* | *Expert review team assessment* | *ERT findings and recommendations* |
|---|---|---|
| categories in the UNFCCC inventory? | | |
| Does the Party use the key category analysis to prioritize inventory improvements? | Yes | |
| *Assessment of uncertainty analysis* | | |
| Approach followed? | Tier 1 | |
| Was the uncertainty analysis carried out in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF? | Yes | Please see paragraphs 45 and 66 below for category-specific recommendations |
| Quantitative uncertainty (including LULUCF) | Level = 30.0%<br>Trend = 6.5% | |
| Quantitative uncertainty (excluding LULUCF) | Level = 4.5%<br>Trend = 1.8% | |

*Abbreviations*: ERT = expert review team, IPCC good practice guidance = the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, IPCC good practice guidance for LULUCF = IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, LULUCF = land use, land-use change and forestry

Inventory management

18. There were no changes to the inventory management process carried out by Sweden for the 2014 annual submission, as indicated by the Party in its NIR. The description of the inventory management process, as contained in the report of the individual review of the annual submission of Sweden submitted in 2013,[4] remains relevant.

## 5. Follow-up to previous reviews

19. The ERT noted that Sweden has addressed the recommendations made in the 2013 annual review report in its 2014 annual submission. Sweden also provided an overview of ongoing and planned actions and improvements initiated due to the recommendations made in the previous review reports. The improvements carried out by the Party in the 2014 annual submission include:

(a) Enhancement of the explanation of the reasons for the selection and appropriateness of the different databases used for each key category in the energy sector;

(b) Provision of transparent information on emissions from disposal and destruction of F-gases;

(c) Explanation of the reasons for confidentiality of the AD associated with use of $N_2O$ for anaesthesia and aerosol cans;

(d) Clarification of the reasons for the selection of AD for horses and chickens;

[4] FCCC/ARR/2013/SWE, paragraphs 14 and 15.

(e) Revision of the AD for the crop yield time series based on actual yield as opposed to standard yield;

(f) Provision of an explanation of how stratification improves the accuracy of the estimates in the LULUCF sector;

(g) Revision of the use of notation keys in the reporting of LULUCF and KP-LULUCF activities;

(h) Provision of information to explain the consequences of extrapolations applied in the LULUCF sector;

(i) Inclusion of publicly available information directly on a State-owned website.

20. Recommendations from previous reviews that have not yet been implemented, as well as issues the ERT identified during the 2014 annual review, are discussed in the relevant sectoral chapters of the report and in table 9 below.

## B. Energy

### 1. Sector overview

21. The energy sector is the main sector in the GHG inventory of Sweden. In 2012, emissions from the energy sector amounted to 42,147.59 Gg $CO_2$ eq, or 73.2 per cent of total GHG emissions. Since 1990, emissions have decreased by 21.2 per cent. The key drivers for the fall in emissions are: the reduced fossil fuel consumption in the category other sectors; the reduced energy intensity of the economy throughout the time series; and the increased use of biomass for energy purposes. Within the sector, 45.3 per cent of the emissions were from transport, followed by 24.4 per cent from energy industries, 20.2 per cent from manufacturing industries and construction and 7.5 per cent from other sectors. Fugitive emissions from fuels accounted for 2.3 per cent and the category other accounted for 0.4 per cent.

22. Sweden has made recalculations between the 2013 and 2014 annual submissions for this sector. The two most significant recalculations made by Sweden between the 2013 and 2014 annual submissions were in the following categories: transport, and manufacturing industries and construction. The recalculations were made following changes in AD and EFs. Compared with the 2013 annual submission, the recalculations decreased emissions in the energy sector by 407.17 Gg $CO_2$ eq (0.07 per cent) in 2012. The recalculations were adequately explained.

23. Sweden's inventory is complete in terms of years, categories, gases and geographical coverage. Sweden has used the notation key "NE" (not estimated) to report fugitive $CO_2$ emissions from oil loaded in tanker ships. The ERT noted that the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) only provide $CO_2$ EFs for tanker trucks and not for tanker ships. In response to a recommendation made in the previous review report, Sweden has provided in annex 2 of its NIR a detailed explanation on how energy sector AD for various categories were selected from alternative databases. The ERT considers that the explanations provided by Sweden transparently describes energy sector AD selection processes and methodologies used. Sweden has also provided a detailed carbon balance in chapter 4 of the NIR and showed how the $CO_2$ emissions are allocated across all the

relevant energy and industrial processes source categories. The ERT commends Sweden for reporting its carbon balance.

## 2. Reference and sectoral approaches

24. Table 5 provides a review of the information reported under the reference approach and the sectoral approach, as well as comparisons with other sources of international data. Issues identified in table 5 are more fully elaborated in paragraphs 25–28 below.

Table 5
**Review of reference and sectoral approaches**

| *Issue* | *Expert review team assessment* | *Paragraph cross references* |
|---|---|---|
| Difference between the reference approach and the sectoral approach | Energy consumption: 0.69 PJ, 0.12%<br>$CO_2$ emissions: 86.34 Gg $CO_2$, 0.22% | |
| Are differences between the reference approach and the sectoral approach adequately explained in the NIR and the CRF tables? | Yes | 25 |
| Are differences with international statistics adequately explained? | Yes | 26 |
| Is reporting of bunker fuels in accordance with the UNFCCC reporting guidelines? | Yes | |
| Is reporting of feedstocks and non-energy use of fuels in accordance with the UNFCCC reporting guidelines? | Yes | 28 |

*Abbreviations*: CRF = common reporting format, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories"

Comparison of the reference approach with the sectoral approach and international statistics

25. In response to a recommendation made in the previous review report regarding minimizing the differences between the reference and sectoral approach, Sweden has set up an action plan that involves collaboration between the Swedish Environmental Protection Agency, Swedish Energy Agency, Statistics Sweden and Swedish Environmental Emissions Data (SMED) to investigate and explain reasons for statistical differences in the energy balances, and their effects on the comparison between the reference and sectoral approaches.

26. A comparison of the fuel consumption data reported by Sweden in its CRF tables with the corresponding data reported to the International Energy Agency (IEA) identified differences of 7.5 per cent for residual fuel oil (or 4,501 TJ). In response to a question raised by the ERT during the review, Sweden explained that the amount of residual fuel oil for international navigation reported in the CRF tables is based on the national energy statistics. The ERT noted that liquid fuel consumption for navigation is based on robust energy consumption surveys and that the application of an excise tax on navigation fuels ensures the accuracy of the fuel consumption data for marine bunkers. The ERT recommends that Sweden initiate a process to harmonize the fuel consumption data used for international reporting of marine bunkers to reduce the observed difference between the data reported in the CRF tables and the IEA data.

International bunker fuels

27. No problems were identified.

Feedstocks and non-energy use of fuels

28. No problems were identified. The ERT noted that Sweden followed the recommendation made in the previous review report that the Party provide detailed energy and carbon mass balances for the iron and steel industry in the NIR. This information has been included in annex 3:5 to Sweden's 2014 NIR. The ERT further notes that this has enabled Sweden to report transparently on non-energy use of solid and liquid fuels in the iron and steel industry.

## 3. Key categories

Fuel combustion: liquid fuels – $CO_2$

29. The ERT observed that in addition to the five refineries that Sweden transparently reports on, there are a few other plants with the Swedish Standard Industrial Classification 232 that should be reported under the category petroleum refining. However, clear documentation of the AD for liquid fuels used in these plants has not been provided in the NIR. In response to a question raised by the ERT during the review, Sweden demonstrated that the AD for these plants are available in the quarterly fuel statistics and emission estimates are calculated using country-specific EFs, and that the fuel consumption and emissions from these plants are included in petroleum refining (CRF table 1A1b). Sweden further explained that information on this matter has been clarified in its 2015 NIR. The ERT agreed with Sweden's assessment and recommends that the Party improve the transparency of its NIR by including information on how the plants with the Swedish Standard Industrial Classification 232 are reported in the CRF tables in its next annual submission.

Fuel combustion: biomass – $CH_4$ and $N_2O$

30. The ERT noted that Sweden did not transparently report charcoal use in the NIR and specifically under the category residential (other sectors). During the review, the Party confirmed that charcoal use occurs in Sweden but that combustion-related $CH_4$ and $N_2O$ emissions from charcoal use have not been reported in the 2014 annual submission for the whole time series. The ERT further notes that guidance is provided in the Revised 1996 IPCC Guidelines on EFs for $CO_2$, $CH_4$ (table 1-7) and $N_2O$ (table 1-8). During the review, Sweden informed the ERT that it intends to use a tier 1 methodology by applying AD sourced from official statistics from the Food and Agriculture Organization of the United Nations (FAO) and default $CH_4$ and $N_2O$ EFs from the Revised 1996 IPCC Guidelines to estimate these emissions, and to officially resubmit its GHG inventory thereafter. In the list of potential problems and further questions, the ERT recommended that Sweden estimate emissions from charcoal use using the AD based on the data submitted officially to FAO together with country-specific or default EFs provided in tables 1-7 and 1-8 of the Revised 1996 IPCC Guidelines.

31. In response to the list of potential problems and further questions raised by the ERT, Sweden submitted revised emission estimates including information on $CH_4$ and $N_2O$ emissions from charcoal use. This information was reviewed by the ERT. Sweden used the default EFs and net calorific value for charcoal contained in the Revised 1996 IPCC Guidelines. The recalculation increased GHG emissions from fuel combustion by 0.01 per cent in 2012 (2.89 Gg $CO_2$ eq). The ERT concluded that Sweden's estimate of GHG emissions from charcoal combustion has been prepared in line with the IPCC good practice guidance. The ERT considered the potential problem to have been resolved.

Road transportation: biomass – $CH_4$ and $N_2O$

32. The NIR refers to a "Handbook on Emission Factors for Road Transport" (HBEFA) model that does not include $CH_4$ and $N_2O$ emissions from ethanol (E85) cars and from buses running on pure bioalcohol, and to a SMED model that is used to estimate these emissions. In response to questions raised by the ERT during the review, Sweden explained that to account for these emissions in the road transportation modelling framework, it uses the SMED model. The Party further explained that an implied emission factor (IEF) derived from gasoline consumption and related $N_2O$ and $CH_4$ emissions from passenger cars in HBEFA is applied together with the amount of ethanol consumed by E85 cars and buses. However, the ERT noted that $CH_4$ and $N_2O$ emissions for this source category depend on a number of operational factors and not only fuel properties. In response to additional questions raised by the ERT on whether this approach results in an overestimation or underestimation of $CH_4$ and $N_2O$ emissions from ethanol and bioalcohol, and whether the Party applied a top-down methodology to verify these emissions, Sweden indicated that there are no default $CH_4$ and $N_2O$ EFs for ethanol and bioalcohol in the Revised 1996 IPCC Guidelines or in the IPCC good practice guidance. Hence, Sweden stated there is no means by which it can assess whether these emissions are underestimated or overestimated and indicated that none of the countries that use the road emission model HBEFA has calculated any estimates of $CH_4$ and $N_2O$ emissions from ethanol and bioalcohol for road vehicles and, therefore, there is no top-down methodology available to use for verification. However, given that Sweden is constantly increasing the biofuel blend in gasoline and diesel, the ERT is of the view that the Party should prioritize the accuracy of the emission estimates for this category and the modelling framework used. The ERT encourages Sweden to highlight this issue for improvement.

## 4. Non-key categories

Navigation: liquid fuels – $CO_2$

33. The ERT noted in figure 3.6 of the NIR that there are significant fluctuations in fuel consumption based on the energy statistics for navigation with a 41.3 per cent decrease between 2010 and 2012 without an explanation. These inter-annual fluctuations could be influenced by the methodology used to split fuel consumption between navigation and marine bunkers. In response to a question raised by the ERT during the review, Sweden explained that the split between domestic and international fuel consumption for navigation is based on the results from a national survey conducted by all coal and oil trading companies in Sweden. Hence, the different fuels are separated in the survey. The ERT agrees with the methodology used by Sweden, where the application of value-added tax to fuels consumed for navigation is used to split liquid fuels between navigation and marine bunkers. The ERT recommends that Sweden: provide an explanation of the observed fuel consumption trends between 2000 and 2012.

Other transportation: natural gas – $CO_2$, $CH_4$ and $N_2O$

34. Sweden has reported fugitive emissions associated with natural gas transmission and distribution via pipelines under the category oil and natural gas. However, under the category other transportation Sweden has reported $CO_2$, $CH_4$ and $N_2O$ emissions from pipeline transport as not occurring ("NO"). In response to a question raised by ERT during the review, Sweden explained that the natural gas transmission and distribution company confirmed that an insignificant amount of natural gas is used for pipeline transport and that this amount of natural gas is likely to be reported in the national energy use statistics provided by Statistics Sweden and thus not included in the sectoral approach. The ERT noted that guidance is provided in the Revised 1996 IPCC Guidelines on default EFs for $CO_2$ (tier 1), $CH_4$ (table 1-7) and $N_2O$ (table 1-8) emissions. During the review, Sweden provided preliminary emission estimates using natural gas AD for the period 1990–2012

modelled from 2013 data and a country-specific $CO_2$ EF and default IPCC $CH_4$ and $N_2O$ EFs. The ERT agrees with the emission estimates provided by Sweden. In the list of potential problems and further questions, the ERT recommended that Sweden estimate emissions from use of natural gas for pipeline transport using the methodology, AD and EFs presented to the ERT during the review.

35. In response to the list of potential problems and further questions raised by the ERT, Sweden submitted revised emission estimates. Sweden provided revised emission estimates using natural gas AD for the period 1990–2012 extrapolated from 2013 data and a country-specific $CO_2$ EF and default IPCC $CH_4$ and $N_2O$ EFs. The recalculation increased GHG emissions from fuel combustion by 0.01 per cent in 2012 (0.01 Gg $CO_2$ eq). The ERT concluded that Sweden's estimate of GHG emissions from combustion of natural gas for pipeline transport has been prepared in line with the IPCC good practice guidance. The ERT considered the potential problem to have been resolved.

Solid fuel transformation: biomass – $CH_4$

36. The ERT noted that $CH_4$ emissions from solid fuel transformation are reported as not applicable ("NA"). In response to a question raised by the ERT during the review on charcoal production, Sweden confirmed that fugitive emissions from charcoal production have not been reported in the 2014 annual submission for the whole time series. The ERT notes that guidance is provided in the Revised 1996 IPCC Guidelines (table 1-14) on $CH_4$ EFs for charcoal production. Sweden informed the ERT that it intends to use a tier 1 methodology to estimate these emissions by applying AD sourced from official FAO statistics and a default $CH_4$ EF from the Revised 1996 IPCC Guidelines, and to officially resubmit its GHG inventory thereafter. In the list of potential problems and further questions, the ERT recommended that Sweden estimate emissions fugitive $CH_4$ emissions using the AD on charcoal production submitted officially to FAO, and multiply these AD with a country-specific or default $CH_4$ EF provided in table 1-14 of the Revised 1996 IPCC Guidelines.

37. In response to the list of potential problems and further questions raised by the ERT, Sweden submitted revised emission estimates. Sweden provided revised emission estimates by applying AD sourced from official FAO statistics and a default $CH_4$ EF from the Revised 1996 IPCC Guidelines. The recalculation increased GHG emissions from fuel combustion by less than 1.0 per cent in 2012 (0.44 Gg $CO_2$ eq). The ERT concluded that Sweden's estimate of GHG emissions from charcoal production has been prepared in line with the IPCC good practice guidance. The ERT considered the potential problem to have been resolved.

## C. Industrial processes and solvent and other product use

### 1. Sector overview

38. In 2012, emissions from the industrial processes sector amounted to 5,898.77 Gg $CO_2$ eq, or 10.2 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 302.66 Gg $CO_2$ eq, or 0.5 per cent of total GHG emissions. Since the base year, emissions have decreased by 10.5 per cent in the industrial processes sector, and decreased by 9.0 per cent in the solvent and other product use sector. The key driver for the fall in emissions in the industrial processes sector is the impact of the economic recession on metal production, more specifically in the iron and steel industry. Within the industrial processes sector, 44.9 per cent of the emissions were from metal production, followed by 36.4 per cent from mineral products, 13.7 per cent from consumption of halocarbons and $SF_6$ and 3.6 per cent from the chemical industry. The remaining 1.4 per cent were from other production.

39. Sweden has made recalculations between the 2013 and 2014 annual submissions for the industrial processes sector. The most significant recalculation made by the Party between the 2013 and 2014 annual submissions was in the following category: iron and steel production. The recalculation was made following changes in AD and in order to rectify identified errors. Compared with the 2013 annual submission, the recalculations decreased emissions in the industrial processes sector by 318.96 Gg $CO_2$ eq (5.78 per cent) in 2012. The recalculations were adequately explained.

40. Sweden's inventory is complete in terms of years, categories, gases and geographical coverage. Sweden has used the notation key "NE" to report $CO_2$ and $CH_4$ emissions from base chemicals for plastic industry and from pharmaceutical industry, $CH_4$ and $N_2O$ emissions from other non-specified (chemical industry and other); $CO_2$ emissions from road paving with asphalt and $CO_2$ emissions from food and drink production. The ERT noted that there are no IPCC methodologies available for these source categories. The ERT encourages Sweden to estimate emissions from these non-mandatory source categories.

41. In response to the previous recommendation by ERT on transparency, Sweden has provided explanation of AD sources for each subcategory of the non-F-gases as well as elaboration of QC procedures for key categories wherein large reduction of emissions are observed. Sweden has also provided a detailed carbon mass balance for the iron and steel sector and using the carbon balance to separate emissions related to the energy sector from those that are supposed to be reported in the industrial processes sector. The ERT commends Sweden for these improvements.

## 2. Key categories

Consumption of halocarbons and $SF_6$ – HFCs

42. Sweden calculates actual emissions of F-gases using bulk import and export data which are fed into a national model to calculate emissions from consumption of halocarbons and $SF_6$. This model calculates the estimates based on the consumption of each individual HFC and PFC chemical from each subcategory separately. The data are recorded in the Swedish Chemicals Agency's Products Register. This approach is in line with the tier 2b IPCC methodology. The ERT commends Sweden for the provision of detailed information to describe the model in annex 3.1 to the NIR.

43. The ERT noted the lack of transparency in the reporting on and accounting for collection/destruction, in particular within the above-mentioned national model. In response to a question raised by the ERT during the review, Sweden confirmed that the model includes emissions from collection/destruction/disposal of F-gases. The ERT accepts the response by the Party and recommends that Sweden include this information in the next annual submission to improve the transparency of its reporting.

44. The ERT found that Sweden did not include in its NIR information on the variation of annual leakage rates corresponding to new or old equipment, as recommended in the previous annual review report. In response to a question raised by the ERT during the review, Sweden explained that it was not possible to include information on the variation of leakage rates in the 2014 NIR as it was available after the date of submission, but that it intends to improve the transparency of the information on leakage rates in its next annual submission. The ERT reiterates a recommendation contained in the previous review report that the Party provide the information above in a tabular format in the NIR of the next annual submission to improve the transparency of its reporting.

45. The ERT observed high EF uncertainties for the category refrigeration and air-conditioning equipment (26 per cent for HFCs) compared with the uncertainties provided in the IPCC good practice guidance and the estimates of neighbouring countries. In response

to a question raised by the ERT during the review, Sweden explained that the annual leakage rates are partly not based on manufacture information and are also derived from expert judgement. The ERT recommends that the Party document the methodology used to derive the uncertainty data using expert judgement in the NIR of the next annual submission and revise the uncertainty estimates, if appropriate.

## D. Agriculture

### 1. Sector overview

46. In 2012, emissions from the agriculture sector amounted to 7,641.43 Gg $CO_2$ eq, or 13.3 per cent of total GHG emissions. Since 1990, emissions have decreased by 15.5 per cent. The key driver for the fall in emissions is the decrease in the amount of synthetic fertilizer applied to agricultural soils. Within the sector, 56.9 per cent of the emissions were from agricultural soils, followed by 33.2 per cent from enteric fermentation and 9.9 per cent from manure management.

47. Sweden has made recalculations between the 2013 and 2014 annual submissions for this sector. The most significant recalculation made by Sweden between the 2013 and 2014 annual submissions was in the following category: manure management. The recalculation was made due to revision of the volatile solids parameter. Compared with the 2013 annual submission, the recalculations increased emissions in the agriculture sector in 2011 by 15.87 Gg $CO_2$ eq (0.2 per cent), and increased total national GHG emissions by 0.03 per cent. The recalculation was adequately explained in the NIR.

48. The inventory for the agriculture sector is complete in term of categories, gases, coverage and years and most of the categories have been reported with sufficient transparency. However, data on the nitrogen (N) content of some synthetic fertilizers and the country-specific method used to calculate the $N_2O$ emissions from N leaching and run-off were not provided in the NIR. The ERT recommends that Sweden include this information in its annual submission to improve transparency.

49. All of the recommendations made in the previous review reports have been addressed in the 2014 NIR. The ERT commends Sweden for implementing the recommendations to improve its reporting.

### 2. Key categories

Direct soil emissions – $N_2O$

50. In the previous annual review report, the ERT recommended that Sweden explain the N flow model (STANK) in detail in the NIR. The STANK model is the official model for N input/output accounting at the farm level in Sweden and includes the database of manure and N production and losses. Sweden provided sufficient information on the STANK model in the 2014 NIR.

51. In the previous annual review report, the ERT recommended that Sweden recalculate the estimates of $N_2O$ emissions from N-fixing crops and from crop residues using actual crop yields instead of estimated data for the entire time series in the NIR. Sweden has recalculated the emissions for those subcategories using actual crop yields and has provided information on the parameters and AD used in the 2014 NIR. The ERT commends Sweden for implementing the recommendation to improve the accuracy of the recalculations.

52. The previous annual review report recommended that Sweden include detailed information on the country-specific EF used for animal manure applied to soils in the NIR.

Sweden explained the country-specific EF in the 2014 NIR. The ERT commends Sweden for implementing the recommendation to improve transparency.

Indirect emissions – $N_2O$

53. Sweden used a country-specific method to calculate the $N_2O$ emissions from N leaching and run-off using the follow equation: emissions = area × nitrogen leaching[5] × EF × 44/28.[5] However, the calculation method provided in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance is that applied N multiplies the fraction of leaching and run-off ($Frac_{LEACH}$). Sweden did not use the actual $Frac_{LEACH}$, but estimated the implied $Frac_{LEACH}$. The implied $Frac_{LEACH}$ was between 0.19 and 0.25 from 1990 to 2012, and was lower than the IPCC default value of $Frac_{LEACH}$ (0.30). In response to a question raised by the ERT during the review seeking clarification on the reason why the implied $Frac_{LEACH}$ was lower than the IPCC default value, the Party explained that the "nitrogen leaching" referred to the Swedish model, which was developed to calculate Sweden's emissions of N and phosphorus to the Baltic Sea and was more accurate for the national conditions compared to the IPCC default value because of the use of country-specific AD and parameters on a fine geographic scale. Sweden also provided the ERT with a report[6] on the model. The ERT commends Sweden for developing the calculation method and implied $Frac_{LEACH}$ to better reflect the national conditions. The ERT recommends that Sweden include enhanced justification of the approach used in its next annual submission.

## E. Land use, land-use change and forestry

### 1. Sector overview

54. In 2012, net removals from the LULUCF sector amounted to 35,418.25 Gg $CO_2$ eq. Since 1990, net removals have decreased by 8.5 per cent. The key drivers for the fall in removals are the increase in felling and the impact of the severe storms that occurred in the period 2005–2007. Within the sector, 42,422.33 Gg $CO_2$ eq of net removals were from forest land. Net emissions were reported from settlements (4,638.31 Gg $CO_2$ eq) and from cropland (2,021.35 Gg $CO_2$ eq). Grassland accounted for net emissions of 285.84 Gg $CO_2$ eq and wetlands accounted for 58.57 Gg $CO_2$ eq. Other land was reported as "NA".

55. Sweden has made recalculations between the 2013 and 2014 annual submissions for this sector. The most significant recalculations made by Sweden between the 2013 and 2014 annual submissions were in the following categories: forest land, cropland and settlements. The recalculations were made in response to the 2013 annual review report in order to estimate living biomass using a new model and due to the availability of new data derived from the updated Swedish National Forest Inventory. Compared with the 2013 annual submission, the recalculations increased net removals in the LULUCF sector by 248.00 Gg $CO_2$ eq to 6,968.83 Gg $CO_2$ eq for the period 1990–2011 (–0.8 to 21.3 per cent). The recalculations were adequately explained.

56. The ERT noted that Sweden's QA/QC procedures are generally well designed, and that the Party continues to make efforts to improve the QA/QC system for the LULUCF sector. However, the ERT observed several errors related to the LULUCF sector in the NIR, which were confirmed by the Party in response to a question raised by the ERT during the review to be errors in the reporting of information and data in the NIR tables. The ERT reiterated the recommendation that Sweden improve its QA/QC procedures and report the correct estimates in a consistent manner in the NIR of its next annual submission.

[5] Nitrogen leaching is the amount for nitrogen leaching per unit area.

[6] <http://www.naturvardsverket.se/Documents/publikationer/978-91-620-5995-8.pdf>.

### 2. Key categories

Forest land remaining forest land – $CO_2$

57. In response to a question raised by the ERT during the review regarding the provision of detailed information on dead wood, Sweden provided the ERT with additional information describing the definition, criteria of decay classes, density and carbon concentration by species used and most of the related documentation referenced in the annual submission, including the approach used to derive the country-specific methodologies, and the models used to estimate emissions and removals from dead wood. Nevertheless, the AD on the volume of dead wood, the density of the decay classes for each species and the carbon concentration for birch are not transparently described in the NIR and information was not provided to the ERT during the review. Furthermore, specific information (e.g. decomposition functions) for below-ground dead wood are not transparently described in the NIR. The ERT recommends that the Party include additional and clearer descriptions of the AD, EFs and other parameters used to estimate removals and emissions from dead wood.

$N_2O$ emissions from disturbance associated with land-use conversion to cropland – $N_2O$

58. The ERT noted that Sweden applies a tier 1 methodology and default EFs for the reporting of $N_2O$ emissions from disturbance associated with land-use conversion to cropland. Therefore, the ERT reiterates the recommendation in the previous review report that Sweden make efforts to develop country-specific carbon/nitrogen ratios based on measurements of soil organic carbon (SOC) to improve the accuracy of the $N_2O$ emission calculations using a tier 2 method.

### 3. Non-key categories

Settlements – $CO_2$

59. The inventory for the LULUCF sector is generally transparent but the ERT noted that the Party applied various assumptions about the EFs for litter and SOC. Sweden describes the litter and SOC EFs used for land conversions to roads, power lines and proper settlements in the NIR. Sweden assumes that all or some litter will decompose over 20 years, although litter is generally removed instantly under most construction. In response to a question raised by the ERT during the review, Sweden explained that the litter is moved from the place where it originates, but it is still unclear whether the litter is moved to the same land category or to a different one. The ERT recommends that Sweden include a clearer explanation the management of litter in its next annual submission.

## F. Waste

### 1. Sector overview

60. In 2012, emissions from the waste sector amounted to 1,620.00 Gg $CO_2$ eq, or 2.8 per cent of total GHG emissions. Since 1990, emissions have decreased by 52.6 per cent. The key driver for the fall in emissions is the implementation of policies, measures and economic instruments that have led to a dramatic reduction in the amount of landfilled solid organic waste. Within the sector, 67.6 per cent of the emissions were from solid waste disposal on land, followed by 28.4 per cent from wastewater handling and 4.0 per cent from waste incineration.

61. Sweden has made recalculations between the 2013 and 2014 annual submissions. The most significant recalculation made by the Party between the 2013 and 2014 annual submissions was in the following category: wastewater handling. The recalculation was made following changes in AD. Compared with the 2013 annual submission, the

recalculations increased 2011 emissions in the waste sector by 3.14 Gg $CO_2$ eq (0.2 per cent), and increased total national GHG emissions by 0.005 per cent. The recalculations were adequately explained.

62. The inventory for the waste sector is mostly prepared in a transparent and complete manner. Sweden continues to make efforts to improve the quality and transparency of the inventory.

## 2. Key categories

Solid waste disposal on land – $CH_4$

63. Emissions from solid waste disposal on land amounted to 1,094.49 Gg $CO_2$ eq applying the IPCC tier 2 methodology with country-specific parameters and IPCC default values. Since 1990, emissions from this category have decreased by 61.9 per cent. Sweden has reported in the NIR the degradable organic carbon (DOC) values of various wastes without clear background explanation that supports how the DOC values have been obtained. In response to a question raised during the review, Sweden explained that official waste statistics are produced by collecting waste data using a detailed waste nomenclature and that this makes it possible to estimate the DOC content accurately on the European Waste Catalogue stat level when waste is aggregated. The ERT agrees with the assessment made by Sweden and noted that transparency in the methodology used to aggregate DOC estimates in tables 8.16 and 8.17 of the NIR can be improved. The ERT recommends that Sweden provide a description on how the aggregated DOC values reported in the NIR are estimated, as well as quantification of uncertainty associated with the DOC values, in its next submission.

Wastewater handling – $CH_4$ and $N_2O$

64. Emissions from wastewater handling amounted to 459.92 Gg $CO_2$ eq and have decreased by 8.4 per cent since 1990. Sweden estimated $CH_4$ emissions by applying the check method for the small wastewater treatment plant, and reported no $CH_4$ emissions from the large plant using aerobic wastewater treatment processes. During the review, Sweden indicated that results from the implementation of an IPCC default methodology will be presented in the 2015 submission. The ERT welcomes these proposed improvements and recommends that Sweden use the IPCC default method in accordance with the decision tree to estimate $CH_4$ emissions from domestic wastewater handling. Because anaerobic conditions can be partly formed, even in aerobic treatment plants, the ERT encourages Sweden to determine a country-specific $CH_4$ correction factor value for the large wastewater treatment plant, as well as for the untreated discharge system, to improve the quality of the inventory in the next annual submission.

Waste incineration – $CO_2$

65. Emissions from waste incineration amounted to 65.59 Gg $CO_2$ eq using continuous emission measurement results of $CO_2$ and the fossil carbon fraction. Sweden has reported that the fossil carbon faction was 37.0 per cent according to the operating company of the waste incineration plant. This is supported by a Swedish study done in 2012 that showed that one third of the carbon in solid waste is of fossil origin. Therefore, the ERT is of the view that the fossil carbon fraction reported by the waste incineration plant does not result in underestimation of emissions. The ERT encourages Sweden to continuously monitor the fossil carbon fraction of waste incinerated periodically and report the results of such studies in its future submissions.

66. Sweden has reported the measurement uncertainties using the IPCC defaults. The ERT encourages Sweden to report the measurement uncertainties from the continuous

measurement results of $CO_2$ instead of reporting the IPCC default uncertainties in the next annual submission.

## G. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

### 1. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Overview

67. Table 6 provides an overview of the information reported and parameters selected by Sweden under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 6
**Supplementary information reported under Article 3, paragraphs 3 and 4, of the Kyoto Protocol**

| *Issue* | *Expert review team assessment, if applicable* | *Findings and recommendations* |
|---|---|---|
| Assessment of Sweden's reporting in accordance with the requirements in paragraphs 5–9 of the annex to decision 15/CMP.1 | Sufficient | Sweden's approaches and methodologies for identifying units of land subject to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol meet the requirements referred to in decision 15/CMP.1, and in the annex, paragraph 6 (see para. 69 below) |
| Activities elected under Article 3, paragraph 4 | Activities elected: forest management<br><br>Years reported: 2008, 2009, 2010, 2011 and 2012 | |
| Period of accounting | | Commitment period accounting |
| Sweden's ability to identify areas of land and areas of land-use change in accordance with paragraph 20 of the annex to decision 16/CMP.1 | Sufficient | |

68. Chapter G.1 includes the ERT's assessment of the 2014 annual submission against the Article 8 review guidelines and decisions 15/CMP.1 and 16/CMP.1. In accordance with decision 6/CMP.9, Parties will begin reporting KP-LULUCF activities in the submissions due by 15 April 2015 using revised CRF tables, as contained in the annex to decision 6/CMP.9. Owing to this change in the CRF tables for KP-LULUCF activities and the change from the first commitment period to the second commitment period, paragraphs 69–72 below contain the ERT's assessment of the Party's adherence to the current reporting guidelines and do not provide specific recommendations for reporting these activities in the 2015 annual submission.

69. Sweden reported that the spatial assessment unit is a permanent sample plot, which represents a certain area in the estimation algorithm so that all sample plots together represent the total area of Sweden. The ERT concluded that Sweden's approaches and methodologies for identifying units of land subject to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol meet the requirements referred to in decision 15/CMP.1, and in the annex, paragraph 6.

Activities under Article 3, paragraph 3, of the Kyoto Protocol

*Afforestation and reforestation – $CO_2$*

70. The ERT welcomes the positive response of Sweden to a recommendation in the previous review report that the Party use the same extrapolation method for KP-LULUCF activities and categories for the reporting under the Convention in its 2014 annual submission. Sweden has changed the extrapolation method used for the estimation of areas subject to afforestation and reforestation activities to improve the consistency of the reporting between the Kyoto Protocol and the Convention. This change resulted in a decrease in the estimation of the afforestation and reforestation area. Compared with the 2013 annual submission, the recalculations resulted in a decrease in the total afforestation and reforestation area by 112.51 kha over the period 2008–2011 (by 11.2 per cent). This in turn resulted in an increase in net removals of 1,733.16 Gg $CO_2$ eq over the period 2008–2011. The reason for the change in the net removals and IEF is due to the larger proportion of permanent sample plots used to estimate the carbon stock changes and a new extrapolation method used to ensure time-series consistency. The ERT considers this assessment to be in line with the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* and decisions 15/CMP.1 and 16/CMP.1.

*Deforestation – $CO_2$*

71. Sweden defined deforestation as land-use conversions from forest land (managed) to other managed land (cropland, grassland and settlements) and did not report emissions from forest land converted to unmanaged wetlands and other lands. In response to questions raised by the ERT during the review, Sweden explained that the land cover change is not directly human-induced since these are natural vegetation cover change processes. Hence, the emissions and removals are not reported in accordance with decision 16/CMP.1, annex, paragraph 8. The Party indicated in the NIR that these natural transition land areas continue to be reported throughout the current and subsequent commitment periods in accordance with decision 16/CMP.1, annex, paragraph 19. The ERT agrees with this interpretation, but encourages the Party to provide a table documenting specific areas of degraded forest land converted to unmanaged wetlands to improve the transparency of the reporting of these areas.

Activities under Article 3, paragraph 4, of the Kyoto Protocol

*Forest management – $CO_2$*

72. The Party has provided information that demonstrates that the emissions and removals associated with activities under Article 3, paragraph 4, of the Kyoto Protocol are not accounted for under activities under Article 3, paragraph 3, of the Kyoto Protocol. The ERT would, however, encourage the Party to use the headings provided in the annotated outline of the NIR to improve the transparency of the reporting of this information. For example, a description of how the definitions of activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol have been consistently applied over time may assist in transparently documenting that emissions and removals associated with activities under Article 3, paragraph 4, are not accounted for under activities under Article 3, paragraph 3.

## 2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

73. Sweden has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings and recommendations included in the standard independent assessment report (SIAR) on the SEF tables and the SEF comparison report.[7] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10.

74. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with decision 15/CMP.1, annex, chapter I.E, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements referred to in decision 22/CMP.1, annex, paragraph 88(a–j). The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. Discrepancies concerning Data Exchange Standard (DES) response code 5061 were been identified by the ITL and no non-replacement has occurred. The reported discrepancies did not impact the accurate accounting of Kyoto Protocol units as the transactions were terminated. The national registry has adequate procedures in place to minimize discrepancies.

Accounting of activities under Article 3, paragraph 3, of the Kyoto Protocol and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol

75. Sweden has reported information on its accounting of KP-LULUCF in the accounting table, as included in the annex to decision 6/CMP.3. Information on the accounting of KP-LULUCF has been prepared and reported in accordance with decisions 16/CMP.1 and 6/CMP.3.

76. Table 7 shows the accounting quantities for KP-LULUCF as reported by the Party and the final values after the review.

Table 7

**Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol, in t $CO_2$ eq**

| | *2014 annual submission*[a] | | |
|---|---|---|---|
| | *As reported* | *Revised estimates* | *Final accounting quantity*[b] |
| Afforestation and reforestation | | | |
| Non-harvested land | –6 700 036 | | –6 700 036 |
| Harvested land | NO | | NO |
| Deforestation | 16 682 623 | | 16 682 623 |
| Forest management | –20 615 921 | | –20 615 921 |
| Article 3.3 offset[c] | –9 982 588 | | –9 982 588 |
| Forest management cap[d] | –10 633 333 | | –10 633 333 |

[7] The SEF comparison report is prepared by the international transaction log (ITL) administrator and provides information on the outcome of the comparison of data contained in the Party's SEF tables with corresponding records contained in the ITL.

| | 2014 annual submission[a] | | |
|---|---|---|---|
| | As reported | Revised estimates | Final accounting quantity[b] |
| Cropland management | NA | | NA |
| Grazing land management | NA | | NA |
| Revegetation | NA | | NA |

*Abbreviations:* CRF = common reporting format, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] The values included under the 2014 annual submission are the cumulative accounting values for 2008, 2009, 2010, 2011 and 2012, as reported in the accounting table of the KP-LULUCF CRF tables for the inventory year 2012.

[b] The "final accounting quantity" is the quantity of Kyoto Protocol units that the Party shall issue or cancel under each activity under Article 3, paragraph 3, and paragraph 4, if relevant, based on the final accounting quantity in the 2014 annual submission.

[c] "Article 3.3 offset": for the first commitment period, a Party included in Annex I to the Convention that incurs a net source of emissions under the provisions of Article 3, paragraph 3, of the Kyoto Protocol may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to a level that is equal to the net source of emissions under the provisions of Article 3, paragraph 3, but not greater than 9.0 megatonnes of carbon times five, if the total anthropogenic greenhouse gas emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.

[d] In accordance with decision 16/CMP.1, annex, paragraph 11, for the first commitment period only, additions to and subtractions from the assigned amount of a Party resulting from forest management under Article 3, paragraph 4, of the Kyoto Protocol after the application of decision 16/CMP.1, annex, paragraph 10, and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

77. Based on the information provided in table 7 for the activity afforestation and reforestation, Sweden shall: for non-harvested land, issue 6,700,036 removal units (RMUs) in its national registry.

78. Based on the information provided in table 7 for the activity deforestation, Sweden shall cancel 16,682,623 assigned amount units, emission reduction units, certified emission reduction units and/or RMUs in its national registry.

79. Based on the information provided in table 7 for the activity forest management, Sweden shall issue 20,615,921 RMUs in its national registry.

Calculation of the commitment period reserve

80. Sweden has reported its commitment period reserve in its 2014 annual submission. The Party reported its commitment period reserve to be 288,020,751 t $CO_2$ eq based on the national emissions in its most recently reviewed inventory (57,604.15 Gg $CO_2$ eq). The ERT notes that based on the submission of revised emission estimates by Sweden during the review of the 2014 annual submission, the commitment period reserve changed, and the new commitment period reserve is reported as 288,052,241 t $CO_2$ eq. The ERT agrees with this figure.

## 3. Changes to the national system

81. Sweden reported that there are no changes in its national system since the previous annual submission. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

## 4. Changes to the national registry

82. Sweden reported that there are changes in its national registry since the previous annual submission. The Party described the changes in its NIR. The changes were related to: the EU Emissions Trading System functionality during releases 5 and 6 of the national

registry; regression testing; testing of the new functionality; thorough testing against the DES prior to the release of the version for production; and inclusion of publicly available information directly on a State-run website that is updated on a monthly basis. The ERT concluded that, taking into account the confirmed changes in the national registry, Sweden's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP).

### 5. Minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

83. Consistent with paragraph 23 of the annex to decision 15/CMP.1, Sweden provided information relating to how it is striving, under Article 3, paragraph 14, of the Kyoto Protocol, to implement its commitments in such a way as to minimize adverse social, environmental and economic impacts on developing country Parties, particularly those identified in Article 4, paragraphs 8 and 9, of the Convention.

84. Sweden mentioned that it uses impact assessment and environmental impact assessment as a basis for decision-making before policies and measures are implemented. This analysis includes risk assessment of adverse effects of such policies and measures in other countries. The Party's Policy for Global Development, which focuses on rights of poor countries and people, ensures that all policy areas interact in such a way that Sweden can make an effective contribution to equitable and sustainable development. Sweden's research activities also contribute to sustainable development. Interdisciplinary research efforts focus on the large-scale introduction of measures to reduce GHG emissions. Similarly, Sweden's focus on the increased use of bioenergy not only through domestic production but also through increased imports, in particular from developing countries, means that this area of research is at the forefront when prioritizing science research. Sweden's Climate Strategy is designed to minimize the risk of adverse effects by focusing on different types of measures covering the majority of sectors of society both domestically and internationally and all GHGs covered by the Kyoto Protocol.

85. Sweden reported that there are changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol since the previous annual submission. The Party described the changes in the NIR. The changes involve the inclusion of information on Sweden's Policy for Global Development, the Government's Special Climate Change Initiative and the signing of cooperation agreements on the environment or technology transfer with a number of countries, including Brazil, China, India, the Russian Federation and the United States of America. The ERT concluded that, taking into account the confirmed changes in the reporting, the information provided is complete and transparent.

## III. Conclusions and recommendations

### A. Conclusions

86. Table 8 summarizes the ERT's conclusions on the 2014 annual submission of Sweden, in accordance with the Article 8 review guidelines.

Table 8
**Expert review team's conclusions on the 2014 annual submission of Sweden**

| *Issue* | *Expert review team assessment* | *Paragraph cross references for identified problems* |
|---|---|---|
| The ERT concludes that the inventory submission of Sweden is complete with regard to categories, gases, years and geographical boundaries and contains both an NIR and CRF tables for 1990–2012 | | |
| Annex A sources[a] | Complete | |
| LULUCF[b] | Complete | |
| KP-LULUCF | Complete | |
| The ERT concludes that the inventory submission of Sweden has been prepared and reported in accordance with the UNFCCC reporting guidelines | Yes | |
| Sweden's inventory is in accordance with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF | Yes | |
| The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1 | Yes | |
| Sweden has reported information on its accounting of Kyoto Protocol units in accordance with decision 15/CMP.1, annex, chapter I.E, and used the required reporting format tables as specified by decision 14/CMP.1 | Yes | |
| The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1 | Yes | |
| The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions | Yes | |
| Did the Party provide information in the NIR on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol? | Yes | |

*Abbreviations:* Annex A sources = source categories included in Annex A to the Kyoto Protocol, CMP = Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, CRF = common reporting format, ERT = expert review team, IPCC = Intergovernmental Panel on Climate Change, IPCC good practice guidance = IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, IPCC good practice guidance for LULUCF = IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NIR = national inventory report, Revised 1996 IPCC Guidelines = *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Revised 1996 IPCC Guidelines, the IPCC good practice guidance or the IPCC good practice guidance for LULUCF).

## B. Recommendations

87. The ERT identified the issues for improvement listed in table 9. All recommendations are for the next annual submission, unless otherwise specified.

Table 9

**Recommendations identified by the expert review team**

| *Sector* | *Category cross-cutting issue* | *Recommendation* | *Reiteration of previous recommendation?* | *Paragraph cross references* |
|---|---|---|---|---|
| Energy | International statistics | Initiate a process to harmonize the fuel consumption data used for international reporting of marine bunkers to reduce the observed difference between the data reported in the CRF tables and the IEA data | | 26 |
| | Petroleum refining: liquid fuels – $CO_2$ | Explicitly report the quantity of fuel consumed in the additional plants in the next annual submission | | 29 |
| | Other sectors: biomass – $CH_4$ and $N_2O$ | Estimate emissions from charcoal use using the AD based on the data submitted officially to FAO together with country-specific or default EFs provided in tables 1-7 and 1-8 of the Revised 1996 IPCC Guidelines | | 30 |
| | Navigation: liquid fuels – $CO_2$ | Improve transparency on the domestic and international bunker split and the trend therein between 2000 and 2012 | | 33 |
| Industrial processes and solvent and other product use | Consumption of halocarbons and $SF_6$ – HFCs | Provide the information confirming that the model used includes emissions from collection/destruction/disposal of F-gases in the next annual submission to improve the transparency of the reporting | | 43 |
| | | Include, in the NIR of the next annual submission, the explanation that it was not possible to include information on the variation of leakage rates in the 2014 NIR, but that the Party intends to improve the transparency of the information on leakage rates in the next annual submission, which will be provided in a tabular format | Yes | 44 |
| | | Revise the uncertainty estimates for the category refrigeration and air-conditioning equipment and document the methodology used to derive the uncertainty data using expert judgement in the NIR of the next annual submission | | 45 |

| *Sector* | *Category cross-cutting issue* | *Recommendation* | *Reiteration of previous recommendation?* | *Paragraph cross references* |
|---|---|---|---|---|
| Agriculture | General | Include information on the nitrogen content of some synthetic fertilizers and the country-specific method used to calculate the $N_2O$ emissions from nitrogen leaching and run-off in the next annual submission to improve transparency | | 48 |
| | Indirect emissions – $N_2O$ | Include, in the next annual submission, enhanced justification of the approach used to calculate $N_2O$ emissions from nitrogen leaching and run-off | | 53 |
| LULUCF | General | Improve the QC procedures and report the correct estimates in a consistent manner in the NIR of the next annual submission | Yes | 56 |
| | Forest land remaining forest land – $CO_2$ | Include additional and clearer descriptions of the AD and EFs used to estimate removals and emissions from dead wood | | 57 |
| | $N_2O$ emissions from disturbance associated with land-use conversion to cropland – $N_2O$ | Make efforts to develop country-specific carbon/nitrogen ratios based on measurements of soil organic carbon to improve the $N_2O$ emission calculations using a tier 2 method | Yes | 58 |
| | Settlements – $CO_2$ | Include a clearer explanation of the category to which litter is moved in the next annual submission | | 59 |
| Waste | Solid waste disposal on land – $CH_4$ | Provide detailed information on how the waste composition degradable organic carbon values were obtained in the next annual submission | | 63 |
| | Wastewater handling – $CH_4$ and $N_2O$ | Use the IPCC default method in accordance with the decision tree to estimate $CH_4$ emissions from domestic wastewater handling | Yes | 64 |

*Abbreviations*: AD = activity data, CRF = common reporting format, EF = emission factor, ERT = expert review team, F-gases = fluorinated gases, FAO = Food and Agriculture Organization of the United Nations, IEA = International Energy Agency, IPCC = Intergovernmental Panel on Climate Change, LULUCF = land use, land-use change and forestry, NIR = national inventory report, QA/QC = quality control/quality control, Revised 1996 IPCC Guidelines = *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*.

# IV. Questions of implementation

88. No questions of implementation were identified by the ERT during the review.

# Annex I

## Information to be included in the compilation and accounting database

Table 10

**Information to be included in the compilation and accounting database in t $CO_2$ eq for 2012, including the commitment period reserve**

| | *As reported* | *Revised estimates* | *Adjustment*[a] | *Final*[b] |
|---|---|---|---|---|
| **Commitment period reserve** | 288 020 751 | 288 052 241 | | 288 052 241 |
| **Annex A emissions for 2012** | | | | |
| $CO_2$ | 45 710 293 | 45 713 252 | | 45 713 252 |
| $CH_4$ | 4 804 100 | 4 807 239 | | 4 807 239 |
| $N_2O$ | 6 191 206 | 6 191 407 | | 6 191 407 |
| HFCs | 774 543 | | | 774 543 |
| PFCs | 68 920 | | | 68 920 |
| $SF_6$ | 55 088 | | | 55 088 |
| **Total Annex A sources**[c] | **57 604 150** | **57 610 448** | | **57 610 448** |
| **Activities under Article 3, paragraph 3, for 2012** | | | | |
| 3.3 Afforestation and reforestation on non-harvested land for 2012 | –1 370 134 | | | –1 370 134 |
| 3.3 Afforestation and reforestation on harvested land for 2012 | NO | | | NO |
| 3.3 Deforestation for 2012 | 3 899 649 | | | 3 899 649 |
| **Activities under Article 3, paragraph 4, for 2012**[d] | | | | |
| 3.4 Forest management for 2012 | –39 558 432 | | | –39 558 432 |
| 3.4 Cropland management for 2012 | NA | | | NA |
| 3.4 Cropland management for the base year | NA | | | NA |
| 3.4 Grazing land management for 2012 | NA | | | NA |
| 3.4 Grazing land management for the base year | NA | | | NA |
| 3.4 Revegetation for 2012 | NA | | | NA |
| 3.4 Revegetation for the base year | NA | | | NA |

*Abbreviations*: Annex A sources = source categories included in Annex A to the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] "Adjustment" is relevant only for Parties for which the expert review team (ERT) has calculated one or more adjustment(s). ERTs must review the Party's annual submission to determine if adjustments applied in previous years have been recalculated by the Party. If not, the adjustment from the previous annual review report should be included in this column.

[b] "Final" includes revised estimates, if any, and/or adjustments, if any.

[c] The values for "Total Annex A sources" in the columns "As reported", "Revised estimates" and "Final" may not equal the sum of the values for the gases in those columns owing to rounding.

[d] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 11

**Information to be included in the compilation and accounting database in t $CO_2$ eq for 2011**

| | *As reported* | *Revised estimates* | *Adjustment*[a] | *Final*[b] |
|---|---|---|---|---|
| **Annex A emissions for 2011** | | | | |
| $CO_2$ | 48 479 123 | 48 482 516 | | 48 482 516 |
| $CH_4$ | 4 940 993 | 4 944 187 | | 4 944 187 |
| $N_2O$ | 6 270 348 | 6 270 552 | | 6 270 552 |
| HFCs | 820 096 | | | 820 096 |
| PFCs | 183 430 | | | 183 430 |
| $SF_6$ | 60 248 | | | 60 248 |
| **Total Annex A sources**[c] | **60 754 237** | **60 761 029** | | **60 761 029** |
| **Activities under Article 3, paragraph 3, for 2011** | | | | |
| 3.3 Afforestation and reforestation on non-harvested land for 2011 | –1 338 091 | | | –1 338 091 |
| 3.3 Afforestation and reforestation on harvested land for 2011 | NO | | | NO |
| 3.3 Deforestation for 2011 | 3 777 095 | | | 3 777 095 |
| **Activities under Article 3, paragraph 4, for 2011**[d] | | | | |
| 3.4 Forest management for 2011 | –40 103 698 | | | –40 103 698 |
| 3.4 Cropland management for 2011 | NA | | | NA |
| 3.4 Cropland management for the base year | NA | | | NA |
| 3.4 Grazing land management for 2011 | NA | | | NA |
| 3.4 Grazing land management for the base year | NA | | | NA |
| 3.4 Revegetation for 2011 | NA | | | NA |
| 3.4 Revegetation for the base year | NA | | | NA |

*Abbreviations*: Annex A sources = source categories included in Annex A to the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] "Adjustment" is relevant only for Parties for which the expert review team (ERT) has calculated one or more adjustment(s). ERTs must review if adjustments applied in previous years have been recalculated by the Party. If not, the adjustment from the previous annual review report should be included in this column.

[b] "Final" includes revised estimates, if any, and/or adjustments, if any.

[c] The values for "Total Annex A sources" in the columns "As reported", "Revised estimates" and "Final" may not equal the sum of the values for the gases in those columns owing to rounding.

[d] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 12
**Information to be included in the compilation and accounting database in t $CO_2$ eq for 2010**

| | *As reported* | *Revised estimates* | *Adjustment*[a] | *Final*[b] |
|---|---|---|---|---|
| **Annex A emissions for 2010** | | | | |
| $CO_2$ | 52 279 088 | 52 283 360 | | 52 283 360 |
| $CH_4$ | 5 044 078 | 5 047 129 | | 5 047 129 |
| $N_2O$ | 6 669 628 | 6 669 823 | | 6 669 823 |
| HFCs | 848 435 | | | 848 435 |
| PFCs | 158 342 | | | 158 342 |
| $SF_6$ | 72 399 | | | 72 399 |
| **Total Annex A sources**[c] | **65 071 970** | **65 079 488** | | **65 079 488** |
| **Activities under Article 3, paragraph 3, for 2010** | | | | |
| 3.3 Afforestation and reforestation on non-harvested land for 2010 | –1 219 869 | | | –1 219 869 |
| 3.3 Afforestation and reforestation on harvested land for 2010 | NO | | | NO |
| 3.3 Deforestation for 2010 | 2 666 055 | | | 2 666 055 |
| **Activities under Article 3, paragraph 4, for 2010**[d] | | | | |
| 3.4 Forest management for 2010 | –39 093 394 | | | –39 093 394 |
| 3.4 Cropland management for 2010 | NA | | | NA |
| 3.4 Cropland management for the base year | NA | | | NA |
| 3.4 Grazing land management for 2010 | NA | | | NA |
| 3.4 Grazing land management for the base year | NA | | | NA |
| 3.4 Revegetation for 2010 | NA | | | NA |
| 3.4 Revegetation for the base year | NA | | | NA |

*Abbreviations:* Annex A sources = source categories included in Annex A to the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] "Adjustment" is relevant only for Parties for which the expert review team (ERT) has calculated one or more adjustment(s). ERTs must review if adjustments applied in previous years have been recalculated by the Party. If not, the adjustment from the previous annual review report should be included in this column.

[b] "Final" includes revised estimates, if any, and/or adjustments, if any.

[c] The values for "Total Annex A sources" in the columns "As reported", "Revised estimates" and "Final" may not equal the sum of the values for the gases in those columns owing to rounding.

[d] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 13

**Information to be included in the compilation and accounting database in t $CO_2$ eq for 2009**

| | *As reported* | *Revised estimates* | *Adjustment*[a] | *Final*[b] |
|---|---|---|---|---|
| **Annex A emissions for 2009** | | | | |
| $CO_2$ | 46 516 669 | 46 519 842 | | 46 519 842 |
| $CH_4$ | 5 143 787 | 5 146 517 | | 5 146 517 |
| $N_2O$ | 6 450 760 | 6 450 963 | | 6 450 963 |
| HFCs | 869 912 | | | 869 912 |
| PFCs | 35 333 | | | 35 333 |
| $SF_6$ | 80 914 | | | 80 914 |
| **Total Annex A sources**[c] | **59 097 375** | **59 103 481** | | **59 103 481** |
| **Activities under Article 3, paragraph 3, for 2009** | | | | |
| 3.3 Afforestation and reforestation on non-harvested land for 2009 | –1 397 184 | | | –1 397 184 |
| 3.3 Afforestation and reforestation on harvested land for 2009 | NO | | | NO |
| 3.3 Deforestation for 2009 | 3 202 654 | | | 3 202 654 |
| **Activities under Article 3, paragraph 4, for 2009**[d] | | | | |
| 3.4 Forest management for 2009 | –39 389 954 | | | –39 389 954 |
| 3.4 Cropland management for 2009 | NA | | | NA |
| 3.4 Cropland management for the base year | NA | | | NA |
| 3.4 Grazing land management for 2009 | NA | | | NA |
| 3.4 Grazing land management for the base year | NA | | | NA |
| 3.4 Revegetation for 2009 | NA | | | NA |
| 3.4 Revegetation for the base year | NA | | | NA |

*Abbreviations*: Annex A sources = source categories included in Annex A to the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] "Adjustment" is relevant only for Parties for which the expert review team (ERT) has calculated one or more adjustment(s). ERTs must review if adjustments applied in previous years have been recalculated by the Party. If not, the adjustment from the previous annual review report should be included in this column.

[b] "Final" includes revised estimates, if any, and/or adjustments, if any.

[c] The values for "Total Annex A sources" in the columns "As reported", "Revised estimates" and "Final" may not equal the sum of the values for the gases in those columns owing to rounding.

[d] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 14
**Information to be included in the compilation and accounting database in t $CO_2$ eq for 2008**

| | *As reported* | *Revised estimates* | *Adjustment*[a] | *Final*[b] |
|---|---|---|---|---|
| **Annex A emissions for 2008** | | | | |
| $CO_2$ | 49 977 910 | 49 980 293 | | 49 980 293 |
| $CH_4$ | 5 246 941 | 5 249 779 | | 5 249 779 |
| $N_2O$ | 6 611 740 | 6 611 950 | | 6 611 950 |
| HFCs | 868 361 | | | 868 361 |
| PFCs | 225 052 | | | 225 052 |
| $SF_6$ | 83 869 | | | 83 869 |
| **Total Annex A sources**[c] | **63 013 872** | **63 019 303** | | **63 019 303** |
| **Activities under Article 3, paragraph 3, for 2008** | | | | |
| 3.3 Afforestation and reforestation on non-harvested land for 2008 | –1 374 757 | | | –1 374 757 |
| 3.3 Afforestation and reforestation on harvested land for 2008 | NO | | | NO |
| 3.3 Deforestation for 2008 | 3 137 171 | | | 3 137 171 |
| **Activities under Article 3, paragraph 4, for 2008**[d] | | | | |
| 3.4 Forest management for 2008 | –39 976 352 | | | –39 976 352 |
| 3.4 Cropland management for 2008 | NA | | | NA |
| 3.4 Cropland management for the base year | NA | | | NA |
| 3.4 Grazing land management for 2008 | NA | | | NA |
| 3.4 Grazing land management for the base year | NA | | | NA |
| 3.4 Revegetation for 2008 | NA | | | NA |
| 3.4 Revegetation for the base year | NA | | | NA |

*Abbreviations:* Annex A sources = source categories included in Annex A to the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] "Adjustment" is relevant only for Parties for which the expert review team (ERT) has calculated one or more adjustment(s). ERTs must review if adjustments applied in previous years have been recalculated by the Party. If not, the adjustment from the previous annual review report should be included in this column.

[b] "Final" includes revised estimates, if any, and/or adjustments, if any.

[c] The values for "Total Annex A sources" in the columns "As reported", "Revised estimates" and "Final" may not equal the sum of the values for the gases in those columns owing to rounding.

[d] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

# Annex II

## Documents and information used during the review

### A. Reference documents

Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

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"Guidelines for national systems for the estimation of anthropogenic greenhouse gas emissions by sources and removals by sinks under Article 5, paragraph 1, of the Kyoto Protocol". Decision 19/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf# page=14>.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Decision 15/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>.

"Guidelines for review under Article 8 of the Kyoto Protocol". Decision 22/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

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FCCC/ARR/2013/SWE. Report of the individual review of the annual submission of Sweden submitted in 2013. Available at <http://unfccc.int/resource/docs/2014/arr/swe.pdf>.

Standard independent assessment report template, parts 1 and 2. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

## B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Frida Löfström (Swedish Environmental Protection Agency), including additional material on the methodologies and assumptions used.

# Annex III

## Acronyms and abbreviations

| | |
|---|---|
| AD | activity data |
| $CH_4$ | methane |
| CMP | Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol |
| $CO_2$ | carbon dioxide |
| $CO_2$ eq | carbon dioxide equivalent |
| CRF | common reporting format |
| DES | Data Exchange Standard |
| DOC | degradable organic carbon |
| EF | emission factor |
| ERT | expert review team |
| EU | European Union |
| FAO | Food and Agriculture Organization of the United Nations |
| F-gas | fluorinated gas |
| $Frac_{LEACH}$ | fraction of leaching and run-off |
| GHG | greenhouse gas; unless indicated otherwise, GHG emissions are the sum of $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs and $SF_6$ without GHG emissions and removals from LULUCF |
| HFCs | hydrofluorocarbons |
| IEA | International Energy Agency |
| IEF | implied emission factor |
| IPCC | Intergovernmental Panel on Climate Change |
| ITL | international transaction log |
| kha | kilohectare |
| KP-LULUCF | land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol |
| LULUCF | land use, land-use change and forestry |
| N | nitrogen |
| $N_2O$ | nitrous oxide |
| NA | not applicable |
| NE | not estimated |
| NIR | national inventory report |
| NO | not occurring |
| PFCs | perfluorocarbons |
| PJ | petajoule (1 PJ = $10^{15}$ joule) |
| QA/QC | quality assurance/quality control |
| RMU | removal unitSEF standard electronic format |
| $SF_6$ | sulphur hexafluoride |
| SIAR | standard independent assessment report |
| SMED | Swedish Environmental Emissions Data |
| SOC | soil organic content |
| TJ | terajoule (1 TJ = $10^{12}$ joule) |
| UNFCCC | United Nations Framework Convention on Climate Change |